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The ground beetle supertribe Zuphiitae in the southern Levant

(Coleoptera, Carabidae)

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Based on the study of approximately 400 specimens, we give an overview of the systematics and taxonomy, distribution, dispersal power, and habitat preferences of the carabids belonging to the tribes Anthiini, Helluonini, Dryptini, and Zuphiini in the southern Levant (Egypt: Sinai, Israel and Jordan). We provide identification keys for the members of the given taxa in this region. Eleven species of the Zuphiitae sensu Ober & Maddison (2008) have previously been published from the southern Levant. Our study with rigorous examinations of verifiable records updated the known distribution ranges of six species, though the total number of species which occur in the given region remains eleven. – The following two new species are described: *Zuphium orbachi* spec. nov., which is similar to *Zuphium numidicum* Lucas, 1846, but differs in its elongate body shape, specific form of aedeagus and further characters. *Parazuphium salmoni* spec. nov., a microphthalmic species from the superficial underground compartment or in deep soil horizons in the Upper Galilee, has robust antennae and legs, but has an aedeagus similar to that of *P. chevrolatii* Castelnau de Laporte, 1833. – We compiled a list of the 24 known subterranean Zuphiini species (including *Parazuphium salmoni* spec. nov.), all are restricted to the subtropical and tropical zones. – The following taxonomic acts are proposed: *Anthia* (*Thermophilum*) *sexmaculata marginata* Latreille, 1823, stat. rest.; *Zuphium axaridis* Iablokoff-Khnzorian, 1972, syn. nov. of *Zuphium cilicium* Peyron, 1858; *Zuphium olens kochi* Schatzmayr, 1936, syn. nov. of *Zuphium olens* (P. Rossi, 1790) (colour variation). – We present first records of: *Macrocheilus saulcyi* Chevrolat, 1854 for Jordan; *Zuphium olens* (P. Rossi, 1790) for Jordan; *Zuphium cilicium* Peyron, 1858 for Iran; *Zuphium fuscum* Gory, 1931 for Yemen; *Parazuphium chevrolatii* (Castelnau de Laporte, 1833) for Greece; *Parazuphium damascenum* (Fairmaire, 1897) for Cyprus, Greece and Syria; *Polistichus fasciolatus* (P. Rossi, 1790) for Israel.

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Introduction

The Levant, a biogeographic region in the East Mediterranean, is characterized by a remarkable richness of habitats as well as floral and faunal elements. Euro-Siberian, Central Asian, Oriental, Ethiopian, and Mediterranean species are mixed with Saharan and Arabian desert elements, giving this region a unique biotic composition (Furth 1975, Yom-Tov & Tchernov 1988, Waitzbauer & Petutschnig 2004). This fascinating biodiversity has long attracted biologists, including coleopterologists (e. g. Reiche & Saulcy 1855, Bodenheimer 1937), however, the undertaking of taxonomic studies in the Levant, especially of species-rich groups, is not an easy task due to the biogeographic diversity. Moreover, yet many species remain unknown to science, as can be seen by the numerous species descriptions which have been published in recent years. This is also true for one of the most species-rich families of insects, the ground beetles (Schuldt et al. 2009).

The ground beetle supertribe Zuphiitae sensu Ober & Maddison (2008) is comprised of six tribes, of which four occur in the Levant: Anthiini, Zuphiini, Helluonini, and Dryptini (Löbl & Smetana 2003, own observations). Although some of these tribes are species rich, and species belonging to these tribes have been described as early as the 18th century, they have not undergone taxonomic revision for the Palaearctic region. Several Levantine species are known from these tribes (Bodenheimer 1932 and 1937, Baehr 2003a and 2003b, Bousquet 2003, Hůrka 2003, Chikatunov et al. 2006, Timm et al. 2008). Over the last decade we analysed several hundred individuals from the given tribes. This material provides the basis for our systematic-taxonomic analysis. Field work and a literature survey provide the basis for the ecological characterization, as already given for other ground beetle groups (Assmann et al. 2008a and 2012).

The analyses of the material revealed two new taxa, one of them with strongly reduced eyes and a subterranean habitat. While, endogeic and cave-dwelling ground beetles are known from some regions of the western Palaearctic realm, there are apparently few such species in the Middle East. Our surprising record of a previously undescribed subterranean Zuphiini species from the Levant, led us to compile a brief review and comparison of the world distribution ranges of subterranean Zuphiini, and to compare it with that of other subterranean ground beetles.

Material and methods

Delineation of the study area

There are several biogeographical definitions of the Levant (e. g. Por 1975). As material from Lebanon and Syria is hardly accessible for carabidological studies, we focus on the southern Levant which we define as the eastern part of Egypt (Sinai Peninsula), Israel (including areas under Palestinian control), and Jordan. Any information we have about species from Cyprus, Lebanon or Syria is also given. We also add important records from outside the study area if they enlarge the known distribution range.

Collections, distribution records

This study is based on the examination of specimens collected during the authors' field trips to Cyprus, Israel, Jordan and Egypt (Sinai), as well as specimens stored in entomological collections (including material from Europe, Africa, and other parts of Asia for comparisons). We studied approximately 400 specimens from this group but material from Lebanon and Syria is very limited.

The material is stored in the following collections:

CAB	Working collection Assmann, Bleckede (part of ZSM, Germany)
CFB	Working collection Felix, Berkel Enschot, The Netherlands
COQ	Working collection Orbach, Qiryat Tiv'on, (will be transferred to TAU, Israel)
CSS	Working collection Schüle, Stuttgart, Germany
CSW	Working collection Starke, Warendorf (will be transferred to Westfälisches Landesmuseum Münster, Germany)
CWB	Working collection Wrase, Berlin (part of ZSM, Germany)
TAU	National Collections of Natural History, Tel Aviv University, Tel Aviv, Israel
AUB	Natural History Museum, American University of Beirut, Beirut, Lebanon

NHMB Natural History Museum, Entomological Collection, Budapest, Hungary
NHMPr Natural History Museum, Entomological Collection (Kunratic), Prague, Czech Republic
NHMP Muséum National d'Histoire Naturelle, Entomology Department, Paris, France
ZSM Zoological State Collection Munich (Zoologische Staatssammlung München), München, Germany

We reviewed the available literature to collect data on the distribution range, ecology, and biology of the given species (including an unpublished manuscript on the Anthiini: Basilewsky unpublished). Where possible, the nomenclature follows the last Palaearctic Catalogue (Löbl & Smetana 2003) or the world list of ground beetles (Lorenz 2005). All changes of rank or nomenclature published after the Palaearctic Catalogue are ignored if they were published without appropriate scientific argumentation. An example is the rank of the taxon *Thermophilum* Basilewsky, 1950 which is treated as a subgenus of *Anthia* Weber, 1801 by Bousquet (2003) and Lorenz (2005), but as a genus by Kleinfeld (2012) and Häckel & Farkač (2013). The latter authors do not explain the changes in the taxonomic rank of *Thermophilum*. Such changes destabilize nomenclature and must be avoided (Assmann et al. 2008b). The composition of the supertribe Zuphiitae follows Ober and Maddison (2008).

Measurements and photography

The following measurements were used:

BL Maximal linear distance from the tip of the mandibles to the apex of the right elytron (body length)
HW Maximal linear distance across the head (head width including the eyes)
A1–4L Length of the antennomeres from the basal excision to the tip of the given segment (A1L, A2L, A3L, and A4L refer to the length of the antennomeres I (scapus), II, III and IV, respectively)
PL Length of the pronotum from the anterior to the posterior margin along the midline
EL Maximal linear distance from the end of the scutellum to the apex of the right elytron as maximum linear distance (elytra length)
PW Greatest linear transverse distance across the pronotum (pronotum width)
EW Maximum distance across the elytra (elytra width)
PEW Shortest distance between the two outer pronotal margins (prebasal excision width)
PBaW Width of the pronotal base between the tips of the hind angles at the insertions of the seta

These measurements were made at magnifications between 20× and 60× using an ocular micrometer in a Leica MZ 95 stereobinocular microscope. Microsculpture was examined at a magnification of 100×. Dissections were done using standard techniques. Genitalia were preserved and photographed in "Lompe solution" (Lompe 1989) or in Euparal on acetate labels, and pinned beneath the specimens from which they were removed. The photographs were taken with an Olympus E-330 digital camera in combination with a Leica MZ 95 stereobinocular microscope. Postprocessing was done in Adobe Acrobat Professional 7.0. To achieve sufficient depth of focus, up to 40 planes were captured. These were then copied to separate layers, and the out-of-focus planes were masked using a stacking program (Combine ZP).

Data on power of dispersal, phenology, habitat selection, and distribution ranges were estimated as described in Assmann et al. (2012).

Compilation of subterranean Zuphiini species worldwide

We described the currently known distribution ranges of subterranean Zuphiini taxa based on standard databases (Web of Science and Zoological Record), internet searches, monographs, species lists (Baehr 1985, 1986, 2003b and 2014, Lorenz 2005, Ball & Shpeley 2013), and information provided by biospeleologists. We classify all endogeic (= soil adapted and edaphic) and hypogeic (= cave inhabiting or subterranean s. str.) species with typical morphological features (e. g. reduced eyes, depigmentation; Holdhaus 1954, Casale et al. 1998, Giachino & Vailati 2010) as subterranean (s. l.) species. We do not distinguish between the two groups, as the given subterranean horizons form a continuum with gradual transitions (Giachino & Vailati 2010). We also exclude *Parazuphium chevrolatii* (Laporte de Castelnau, 1833) as well as other species with similar morphological character states from this group of species. Although they can live in subterranean habitats (Nitzu & Decu 1998) and sometimes also have small eyes (Hůrka & Pulpán 1981, Hůrka 1982 and 1987), they can also be winged and flight active (Allemand 1992, Fabbri & Degiovanni 2002) and also inhabit epigeic habitats (own observations).

Results

Characterization of the Zuphiitae species in the Levant

Despite its good phylogenetic characterization (Ober & Maddison 2008), it was not possible to find easily recognizable external characters for members of the Zuphiitae supertribe in the Eastern Mediterranean. However, even a layperson can recognize the affiliation of a species to this supertribe by comparing to our habitus photographs (Figs 3, 4, 6, 7, 10, 12). From a morphological point of view, two groups can be easily differentiated from all other ground beetles in the Levant (characters apply only to species of the given region):

Group 1 consists of the Anthiini (genus *Anthia*) and Helluonini (genus *Macrocheilus*), which are well

distinguished by a combination of characters: (i) an enlarged (symmetrical) labrum which largely covers the mandibles (when they are closed, Figs 1 and 2), (ii) black with white or yellow-orange spots on the upper side (Figs 3 and 4), and (iii) a body length of at least 9 mm.

Group 2 consists of the Dryptini (genus *Drypta*) and Zuphiini (genera *Zuphium* and *Parazuphium*), which share the following characters: (i) scape (antennomere 1) longer than the following two or three segments together, (ii) all antennomeres are setose, (iii) apex of the elytra have a membranous fringe and (iv) head with strongly constricted neck (narrowed posterior part of occiput and postocciput).

Species which occur in adjacent regions or which have been previously listed for the Levant are incorporated in the identification keys. If there are no verifiable records from the Levant, the names of the species are given in parentheses.

The body length measurements in the identification key also cover the abdomen of regularly killed and mounted specimens (cf. Cooter & Barcley 2006), and therefore reflect the real body length as used in ecological studies (e. g Homburg et al. 2013 and 2014). The BL measurements as defined in the previous chapter are used for the species descriptions and the taxonomic analyses as these are more accurate.

Identification key to the (sub-) species of Group 1 (Anthiini and Helluonini)

1 Smaller species (10–15 mm), 1 or 2 orange spots on elytron. Body black, only last segments of palpi at the apex lighter and the antennomeres 5 to 11 brownish with a black stripe. Upper and lower surface with dense punctuation and strong pubescence. Fig. 1 and Fig. 4a. .... 1. *Macrocheilus saulcyi* Chevrolat, 1854

– Large species (at least 20 mm), black with white spots on elytra. 2

2 Pronotum with one or two groups of white hairs forming white spots at the outer margin. 3

– Pronotum without a group of hairs forming a white spot (single white hairs are possible). 4

3 Elytron with 1 white humeral spot, 1 large spot on the disk (often with 1 or 2 additional smaller discal spots), the white margin not reaching the shoulder, and 1 apical spot. The white spots of the pronotum smaller, often interrupted in the middle. 20-37 mm. Figs 2 and 3a. .... 2. *Anthia* (*Thermophilum*) *sexmaculata* s. str. (Fabricius, 1787)

– Elytron with 1 large white humeral spot and additional (often 2) basal spots, some white spots on the disk, the white margin continuous from shoulder to apex, and 1 enlarged apical spot (or several small apical spots). The white spot(s) of the pronotum larger. 21–39 mm. Fig. 3b. ..... (*Anthia* (*Thermophilum*) *sexmaculata marginatum* Latreille, 1823)

4 Large species: 40–53 mm. Side of pronotum rounded. Elytral white spots reduced: 1 humeral spot and 1 apical spot, only rarely additional spots. The white margin often continuous from shoulder to apex. Fig. 3c. ....(4. *Anthia* (*Thermophilum*) *venator* (Fabricius, 1792))

– Smaller species: 22–38 mm. Side of pronotum sharply rectangular. Elytron with 1 humeral spot, 3 discal spots (1 in front of the middle and 2 behind it), and 2 apical spots. The white margin does not reach the shoulder. Fig. 3d. .... 3. *Anthia* (*Thermophilum*) *duodecimguttata* Bonelli, 1831

Identification key to the species of Group 2 (Dryptini and Zuphiini)

1 Pronotum without lateral bead. Penultimate tarsal segment bilobed. 2

– Pronotum with lateral bead. Penultimate tarsal segment not strongly bilobed. 3

2 Entirely bluish, sometimes greenish, only mouthparts, antennae and legs yellow to orange or brownish (apical part of scapus darker). Fig. 4c. 7-9 mm. .... 5. *Drypta* (s. str.) *dentata* (P. Rossi, 1790)

– Entirely yellow to brownish, only apical part of scapus darker and a longitudinal blue or green pattern on the elytra. Fig. 4b. 7–9 mm. .... 6. *Drypta* (*Deserida*) *distincta* (P. Rossi, 1792)

3 Pronotum dark (middle to dark brown, as head and part of the elytra). Hairs on the upper side long, some as long as antennomere II. Neck broad, about half of the width of the pronotum. Antennomere I shorter. 4

– Pronotum yellow to light brown or reddish, but never darker than head or parts of the elytral pattern (most species unicolorous yellow to bright brown). Surface with pilosity but hairs shorter, much shorter than antennomere II is long. Neck less wide than half of the pronotum width. Antennomere I longer. 5

Fig. 1. Head with labrum, *Macrocheilus saulcyi*.

Fig. 2. Head with labrum, *Anthia sexmaculata*.

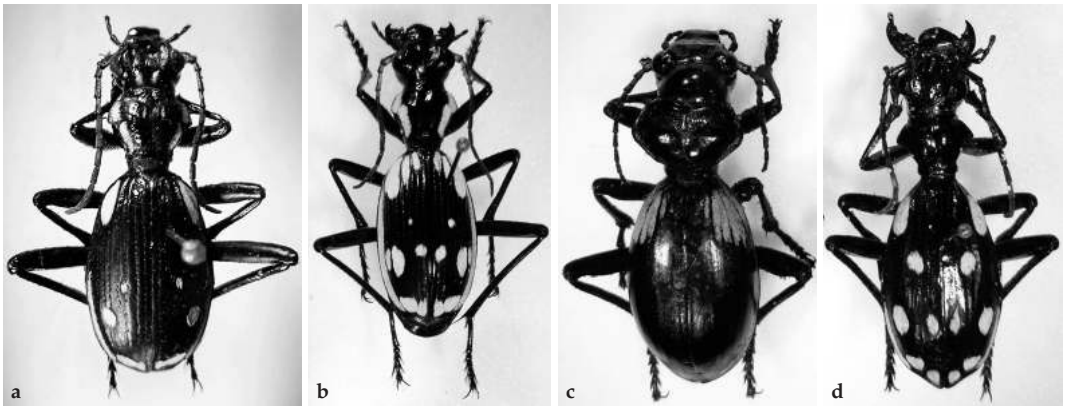

Fig. 3. Habitus of *Anthia* species: **a.** *A. sexmaculata* s.str., **b.** *A. sexmaculata marginata* stat. nov., **c.** *A. venator*, **d.** *A. duodecimguttata*.

4 Orange to reddish pattern of each elytron running from the shoulder to a connection in the apical half ("U-shaped"). Elytral striae strongly punctated. Pro- and mesosternum black. Hind angles of pronotum more protruding, the pronotal base at the hind angles strongly concave. Aedeagus bent to the right (see figure 3b in Toribio 1992). Fig. 4d. 8–9 mm. ....7. *Polistichus fasciolatus* (P. Rossi, 1790)

– Orange to reddish coloration of each elytron running from the shoulder to apical part of elytra without any connection (see figure 63 in Forel & Leplat 2003: 144, figure 961 in Pesarini & Monzini 2011: 105). Elytral striae less punctated. Pro- and mesosternum reddish to brownish. Hind angles of pronotum less protruding, the pronotal base at the hind angles less concave. Aedeagus straight (see figure 3a in Toribio 1992). 8–9 mm. .... (8. *Polistichus connexus* (Geoffroy, 1785))

5 Scape of antennae with numerous small hairs and only one large seta at the apex. Median lobe of aedeagus with large preputial field (= orificium, apical membranous part), in many species on the upper side with two sclerotized clasps, deeply cleft in middle. One pair of supraorbital setae (posterior one is lacking). Apical margin of elytra truncate or rounded, not sinuose. Genital segment circular and sclerotized parts thinner. Figs 6 and 7. 6

– Scape of antennae with further moderately long setae which poke (more or less at a right angle) out of the normal hairs, these setae are smaller

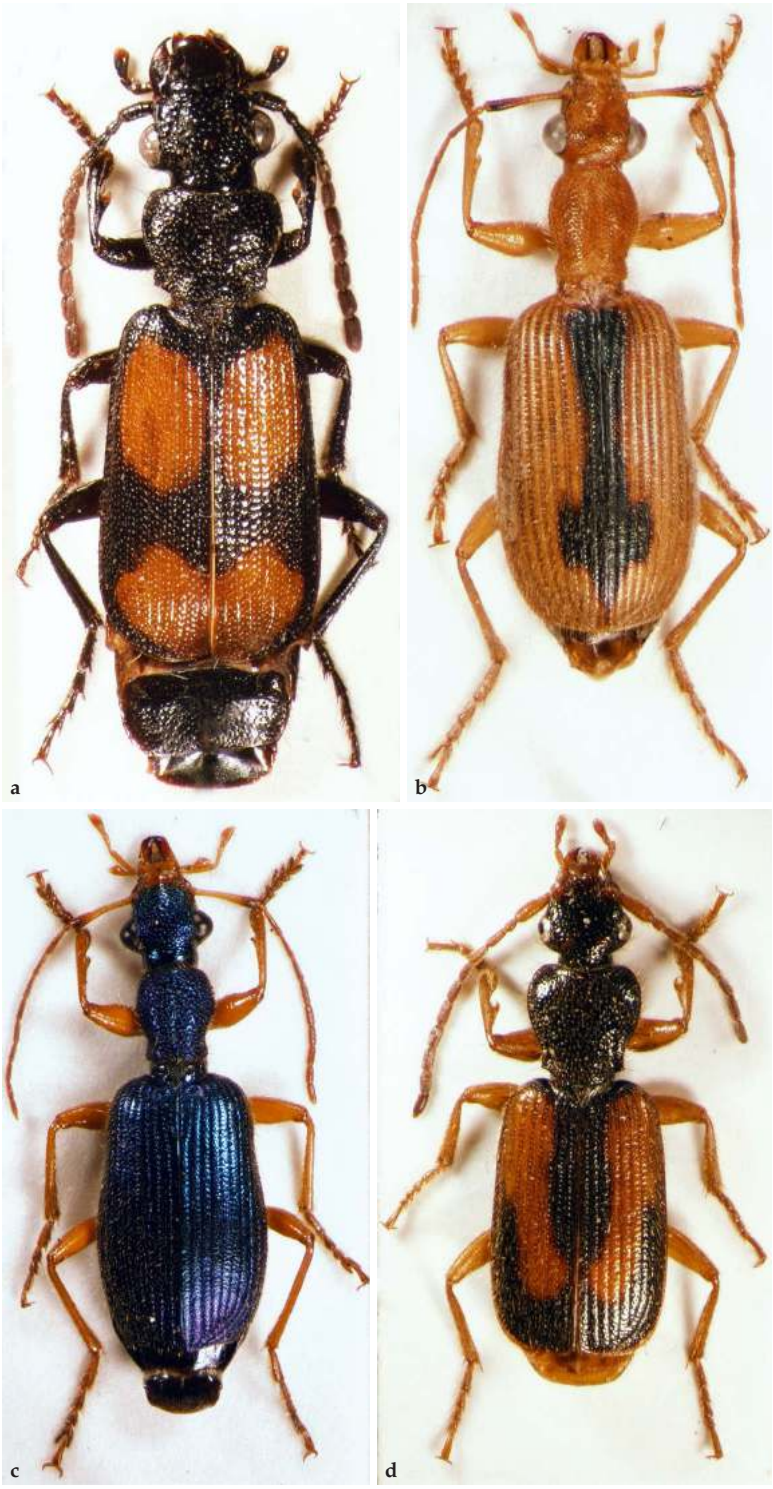

Fig. 4. Habitus of **a.** *Macrocheilus saulcyi*, **b.** *Drypta distincta*, **c.** *Drypta dentata*, **d.** *Polistichus fasciolatus*.

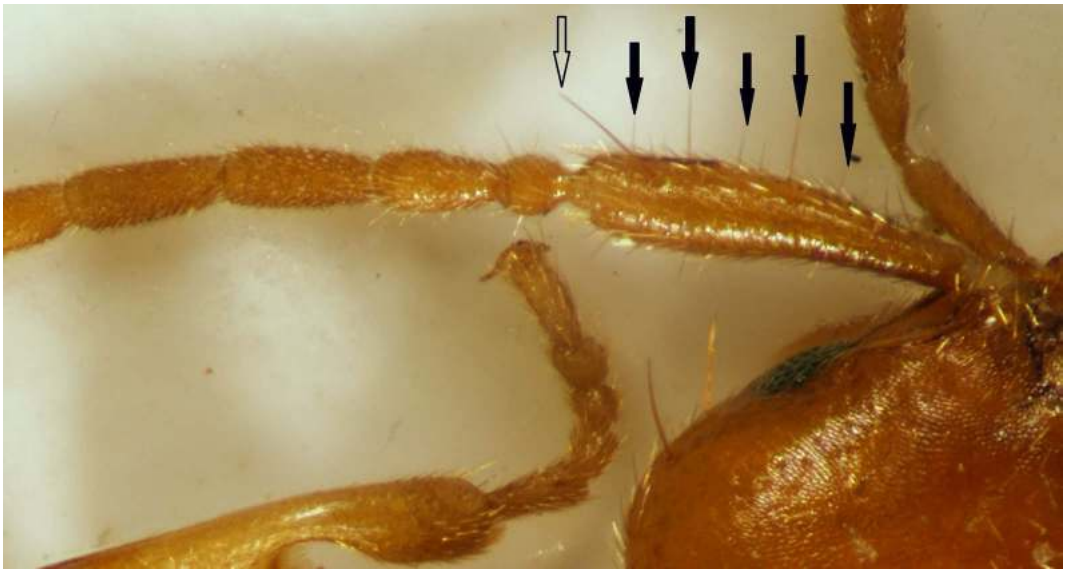

Fig. 5. First antennomeres of *Parazuphium damascenum*. Three types of "hairs" or trichoid setae can be identified on the scapus (= antennomere 1): (i) the single long, erect seta at the end (open arrow), (ii) several, moderately long, erect setae at the anterior margin (filled arrows, not all setae of this type marked), and (iii) numerous, short, decumbent setae.

than the apical large seta but longer than the regular hairs (Fig. 5). Aedeagus compact and grossly sclerotized, with small membranous preputial field. Two pairs of supraorbital setae (the posterior pair in the basal quarter of the head). Apical margin of elytra sinuose. Genital segment rectangular (but sometimes only bilaterally symmetric) and strongly sclerotized. Figs 10 and 12. 12

6 Apex of each elytron separately rounded, not truncate, convergent towards the suture. Figs 6e–f, 7. 7

– Apex of elytra truncate (at least partly straight, never continuously rounded), not convergent towards the suture. Figs 6a–d, g. 9

7 Bicolored species, in apical half of elytra a large dark band or extensive dark areas, head darker than pronotum. Figs 6e, 8c, 9c. 5.5–6.5 mm. .... 12. *Zuphium cilicium* Peyron, 1858

– Unicolorous species, head sometimes darker than pronotum, but elytra without clear dark coloration pattern. 8

8 Head less wide than pronotum, mean body length larger: 5.4–6 mm, larger eyes. Form of the median lobe of aedeagus. Figs 7, 8d, 9d. .... 13. *Zuphium orbachi* spec. nov.

– Head as wide as pronotum, mean body length smaller: 4.5–6 mm, smaller eyes. Form of the median lobe of aedeagus. Figs 6f, 8e, 9e. .... (14 *Zuphium numidicum* Lucas, 1846)

9 Species unicolorous yellow to bright brown. Median lobe of aedeagus slender. 6–7 mm. Figs 8b, 9b. ..... (11. *Zuphium testaceum* Klug, 1832)

– At least parts of head and/or elytra clearly darker than pronotum. Sometimes unicolorous forms of *Z. olens* occur; they have sclerotized claps on the preputial field of median lobe of aedeagus. 10

10 Eyes smaller, less protruding laterally, shorter than temples (dorsal view); head width same across the eyes as long as across the temples. Pronotum wider (HW/PW ~0.7), strongly cordiform (PW/PEW ~1.18), punctation finer and hairs shorter. Fig. 6d. 9.5 mm. .... (10. *Zuphium syriacum* Chaudoir, 1861)

– Eyes larger, strongly protruding laterally, much longer than temples (dorsal view), maximum width of head clearly across the eyes. Pronotum slender (HW/PW > 0.75), less cordiform (PW/PEW > 1.25), punctation stronger and hairs longer. 11

11 Usually head dark and contrasting to the yellow or orange pronotum. Aedeagus more rounded. Figs 6a–c, 8a, 9a. 7–10 mm. .... 9. *Zuphium olens* P. Rossi, 1790

– Head and pronotum unicolorous, yellow to orange. Aedeagus more elongate. Figs 6g, 8f, 9f. 7.5–10 mm. ..... (15 *Zuphium fuscum* Klug, 1931)

12 Metatibia curved, especially in males (Fig. 10a,b). Eyes larger, laterally protruding. Figs 10a,b, 13a. 3.5–5.2 mm. ..... 16. *Parazuphium damascenum* (Fairmaire, 1897)

– Metatibia straight in both genders (Figs 10b, 12). Eyes of variable size. 13

13 Eyes strongly reduced, temples at least three times as long as eyes (dorsal view). Antennae shorter, scapus shorter than the head wide, antennomere II about 1.5 times longer than wide. Figs 11c, 12, 13c, 14b, 15b. 4.2–4.4 mm. .... 17. *Parazuphium salmoni* spec. nov.

– Eyes of variable size, but shorter than temples (dorsal view). Antennae elongate, scapus longer than head is wide, antennomere II about twice as long as wide. Figs 10c,d, 11a,b, 13b, 14a, 15a. 4–6.5 mm. ..... 18. *Parazuphium chevrolatii* Castelnau de Laporte, 1833

Species accounts

1. *Macrocheilus saulcyi* Chevrolat, 1854

Dispersal power: Macropterous and flight active (personal observation).

Habitat selection: In open and semi-open batha habitats (e. g. Fig. 17a), sometimes also under oak trees. In close association with ants; it feeds on them (dissections revealed numerous remnants of ants in the foregut of the beetles). Reinhardt (1974) also reports this feeding habit for South American helluonine species.

Phenology: Reproduction probably in autumn, tenerals from February to May.

Distribution range: From southern Asia Minor to the Levant: Lebanon, Syria, Israel, and Jordan (new for Jordan, see below; Hůrka 2003, Häckel & Farkač 2013).

Distribution in the Levant: In the Mediterranean climate region of the Levant from 200 m below sea level (Sea of Galilee) to about 1200 m above sea level (sothwards to Carmel Mountains and Lower Galilee, TAU, CWB, CSW, CAB; Ajloun Forest, CAB).

Taxonomic notes: A similar species has recently been described from Yemen (Felix & Muilwijk 2007).

2. *Anthia (Thermophilum) sexmaculata* (Fabricius, 1787)

Dispersal power: Brachypterous. The fast and expansive locomotory behaviour probably leads to high dispersal power.

Habitat selection: In sandy semi-desert habitats, especially with shifting sand, but also on soil crusts. The beetle and its larva feed on ants (Dinter et al. 2002). The nominate subspecies can adapt to seasonal changes in climatic conditions by shifting the main activity phase between day and night (Erbeling & Paarmann 1985).

Phenology: Active individuals from February to November. Reproduction takes place in spring and early summer (Dinter et al. 2002).

Distribution range: Nominate subspecies from Morocco to Egypt (northern parts of the Sahara Desert) and the western Levant. See also taxonomic note.

Distribution in the Levant: Syria (Bousquet 2003, Kleinfeld 2012, Häckel & Farkač 2013, but we do not know of any specimen from present-day Syria), Israel (not listed in recent catalogues and monographies, e. g. Bousquet 2003, Kleinfeld 2012, Häckel & Farkač 2013; but see Bodenheimer 1937 for old records): only in the western Negev (Haluza, Agur and Meshash Sands, south of Be'er Sheva), Egypt (incl. Sinai; Alfieri 1976, El-Moursy et al. 2001).

Taxonomic note: Although not listed in the Palaearctic Catalogue (Bousquet 2003), the subspecies *A. sexmaculata marginata* Latreille, 1823 (or 1827, see the note in Kleinfeld 2012 regarding the publication year) also occurs in the countries of the Palaearctic realm: It lives south of the nominate form from Mauritania and West Sahara to Egypt and Sudan and seems to prefer extremely dry habitats (Basilewsky unpublished). In the contact zone with the nominate form (the Nile and its delta) hybrid populations occur (Basilewsky unpublished). Alfieri (1976) lists records of *A. s. marginata* from the Nile delta including Cairo, and from the Isthmic Desert (Ismailia, north-eastern Egypt). *Anthia s. marginata* is well characterized by its coloration and slightly differing proportions of the pronotum and its more elongate elytra (cf. Kleinfeld 2012 and Fig. 3b). Moreover, this subspecies seems to differ in its ecology (Erbeling & Paarmann 1985). However, Häckel & Farkač (2013: 281) rank the taxon *marginata* Latreille as a junior synonym of *sexmaculata* (Fabricius, 1787). Due to the clear differ-

ences between the two taxa we cannot support this classification and reinstate the previous status of the taxon (*Anthia (Thermophilum) sexmaculata marginata* Latreille, 1823 stat. rest.).

3. *Anthia (Thermophilum) duodecimguttata* Bonelli, 1831

Dispersal power: Brachypterous. The fast and expansive locomotory behaviour probably leads to high dispersal power.

Habitat selection: In sandy semi-desert habitats (dunes and sparsely vegetated habitats, Fig. 16a). In Wadi Rum together with *Graphipterus minutulus* Dejean, 1822.

Phenology: Records from February to October (TAU), but reproduction may be restricted to spring and summer (see *A. sexmaculata*).

Distribution range: Arabian Peninsula (Iraq, Qatar, Kuwait, Oman, Saudi Arabia, United Arabian Emirates, Yemen), eastwards to Iran, north- and westwards to Jordan (Kleinfeld 2012, Häckel & Farkač 2013).

Distribution in the Levant: We do not know of any records from Egypt, and Alfieri (1976) does not list this species. However, Bousquet (2003) and Häckel & Farkač (2013) indicate Egypt as part of the distribution range. The distribution range is east of the Sinai, in the Arava Valley (Israel and Jordan), Wadi Rum and northwards to Eastern Badia (Kleinfeld 2012, Basilewsky unpublished, own observations).

Conservation: *Anthia duodecimguttata* has not been recorded from the Israeli side of the Arava Valley since 2003 (material preserved in TAU). Despite painstaking efforts in dune habitats of the Arava Valley, it was not possible to find a recent population in Israel. The reason for the decline is unknown, both habitat loss and desertification are possible causes.

4. *Anthia (Thermophilum) venator* (Fabricius, 1792)

Dispersal power: Brachypterous. The fast and expansive locomotory behaviour probably leads to high dispersal power.

Habitat selection: Sand dunes, especially in the shade of small shrubs and dwarf shrubs. The beetle can switch between nocturnal and diurnal activity (Cloudsley-Thompson 1956).

Phenology: Spring to autumn. Reproduction takes place in spring and early summer (Dinter et al. 2002).

Distribution range: From Mauritania, Senegal and Morocco to Egypt (oases of the Libyan desert) and Niger, Chad and Nigeria (Alfieri 1976, Kleinfeld 2012, Basilewsky unpublished).

Distribution in the Levant: Bousquet (2003) and Häckel & Farkač (2013) list the species for Syria (from where we do not know of any record). Alfieri (1976) lists only populations west of the Nile.

5. *Drypta* (s. str.) *dentata* (P. Rossi, 1790)

Dispersal power: Macropterous and flight active (Chikatunov et al. 2006).

Habitat selection: In wetlands, especially reed beds and floodplains, sometimes also in semi-open habitats (e. g. under *Eucalyptus* trees) (Fig. 17b). In Europe it is also in habitats not influenced by the ground water table (Marggi 1992, Hůrka 1996), e. g. arable fields and meadows. Well adapted to climbing on vegetation (numerous adhesive setae on the lower side of the tarsi). Hibernates in large groups of individuals under stones or bark of trees.

Phenology: Spring breeder with summer larvae. We saw several beetles copulating in April.

Distribution range: From western Europe (Iberian Peninsula) to Iran, northwards to southern Central Europe, southwards to North Africa (Morocco, Algeria, Tunisia), also in tropical Africa (Baehr 2003a). Cyprus (Austin et al. 2008).

Distribution in the Levant: Egypt, Israel (northern parts, especially in the Coastal Plains and northern mountains), Syria (Baehr 2003a, own observations). Probably also in Lebanon. No records from Jordan. In Europe, the species seems to be increasing in abundance and expanding its distribution range (Trautner 1992, Hůrka 1996).

6. *Drypta (Deserida) distincta* (P. Rossi, 1792)

Dispersal power: Macropterous and flight active (own observation).

Habitat selection: In wetlands, also in brackish or even saline habitats (e. g. close to Akko = Acre). In the *Tamariscus* floodplain woodlands of the Sea of Galilee very abundant, especially in tussocks of grasses or *Carices* (Fig. 16b). Mostly on the vegetation, good climber.

Phenology: Spring breeder with summer larvae.

Distribution range: From western Europe (Iberian Peninsula) to the Levant, northwards to southern

Fig. 6. Habitus of *Zuphium* species: **a–c.** *Z. olens*, **d.** *Z. syriacum* (holotype), **e.** *Z. cilicium*, **f.** *Z. numidicum*, **g.** *Z. fuscum* (syntype).

Central Europe, southwards to North Africa, also in tropical Africa (Baehr 2003a).

Distribution in the Levant: Israel (especially in the Coastal Plain and the Jordan Valley), Lebanon, Syria. Probably also in Jordan.

7. *Polistichus fasciolatus* (P. Rossi, 1790)

Dispersal power: Macropterous and flight active (Orbach pers. comm.).

Habitat selection: Dry grasslands, meadows, generally not influenced by high water levels.

Phenology: Unknown.

Distribution range: From the Iberian Peninsula to Central Asia and from Algeria to the northern Mediterranean countries (France, Italy, Turkey).

Distribution in the Levant: Israel: Mount Hermon, in the *Quercus libani* zone, at light (Orbach pers. comm., COQ, TAU). No records from other countries in the Levant.

8. *Polistichus connexus* (Geoffroy, 1785)

Dispersal power: Macropterous and flight active (own observation).

Habitat selection: In wetlands (reed beds, swamps, floodplains, etc.) but sometimes also in arable fields and in brackish marshland, especially on loamy or silty ground. Mainly found in sun-exposed habitats.

Phenology: Spring breeder with summer larvae.

Distribution range: From the Iberian Peninsula to West Siberia and West China (CWB), and from North Africa (Morocco, Algeria and Tunisia) to Central Europe.

Distribution in the Levant: No record.

9. *Zuphium olens* (P. Rossi, 1790)

Dispersal power: Macropterous and flight active.

Habitat selection: In wetlands, especially reed beds, swamps, floodplains, close to winter ponds, and lakes (Fig. 17b).

Phenology: Spring breeder with summer larvae.

Distribution range: From Iberian Peninsula to Southeast Asia and from tropical Africa (CAB) to southern Central Europe.

Distribution in the Levant: Egypt: widespread (Alfieri 1976). Israel: widespread (e. g. Bodenheimer 1932, 1937, Chikatunov et al. 2006), especially in the Coastal Plain and in the Jordan and the Arava Valleys from the border to Lebanon to Eilat. Jordan: first record (Dead Sea area: Wadi Manshala, CAB).

Taxonomical note: The subspecies *kochi* Schatzmayr (1936) was established for individuals with enlarged humeral macula extending to the lateral border of the elytra. Such individuals are not restricted to a given geographic area, but occur together with the (less abundant) nominate form in Egypt and in Israel (and elsewhere as a rare variant, e. g. in South France, CAB; Fig. 6a–c). Therefore, *kochi* Schatzmayr must be treated as a junior synonym of *Zuphium olens*, syn. nov. We have also found a brighter form around the Dead Sea with head only slightly darker than pronotum and a strong reduction of dark elytral pattern (and transitions to the typical form).

10. *Zuphium syriacum* Chaudoir, 1861

Dispersal power: Macropterous.

Habitat selection: Unknown.

Phenology: Unknown.

Distribution range: Only the type specimen from Chaudoir's time labelled "Syria" is known. Chaudoir (1861) received the beetle from Kindermann who is known to have collected close to Akko (= Acre). All records from the literature lack verifiable material (e. g. those from the Israeli Light Trap Survey, see Chikatunov et al. 2006).

Fig. 7. Habitus of *Zuphium orbachi* spec. nov.

Taxonomic note: *Zuphium syriacum* is a virtually unknown species. Chaudoir's collection (preserved in NHMP) contains just one female which fits perfectly to the description by Chaudoir (1861) and must be regarded as the holotype.

11. *Zuphium testaceum* Klug, 1832

Dispersal power: Macropterous.

Habitat selection: Unknown.

Phenology: Unknown.

Distribution range: From South Russia to Central Asia and Iraq, Morocco and Egypt.

Distribution in the Levant: Egypt: only recorded west of the Nile (Alfieri 1976). Unfortunately, no verifiable records available as Alfieri's collection was destroyed (Friedberg, pers. comm.). No records from the Levant.

12. *Zuphium cilicium* Peyron, 1858

(= *Zuphium axaridis* Iablokoff-Khnzorian, 1972; syn. nov.)

Dispersal power: Dimorphic.

Habitat selection: Unknown, the Bulgarian specimen at light.

Phenology: Unknown.

Distribution range: From Southeast Europe to southern Turkey and Iran (first record from Iran, see taxonomic remarks). The listing of Syria in the Palaearctic Catalogue (Baehr 2003b) may refer to the fact that historically the type locality ("Caramanie") belonged to Syria. Listed for Israel (Bodenheimer 1937), but no verifiable records.

Taxonomic remarks: Peyron's collection is preserved in both NHMP and AUB. Unfortunately, we were not able to view the collection in Beirut. Although the type material is supposed to be in Paris, we were unable to locate it, especially due to the state of Pic's collection (cf. Cambefort 2006). We know of only three specimens, a female from Bulgaria (Hieke & Wrase 1988), a female from Iran (first record for Iran: IRAN Hamadan: env. / Al Sadir, NHMPr), and a male from southern Turkey (from Kokain, which is not far from the vague type locality "in the environs of Tarsous, Caramanie"). The median lobe and the overall habitus of the latter specimen (including the striking coloration and the proportion of eyes, head size and pronotum) fit well both to the description of *Z. araxidis* (Iablokoff-Khnzorian 1972) and to the detailed, coloured illustration in the original description by Peyron (1858). Although we were not able to study the types, we confidently treat *Z. axaridis* as a junior synonym of *Z. cilicium*.

13. *Zuphium orbachi* spec. nov.

Dispersal power: Brachypterous.

Habitat selection: See description.

Phenology: Unknown.

Distribution range: See description.

14. *Zuphium numidicum* Lucas, 1846

Dispersal power: Macropterous.

Habitat selection: Probably in grassland habitats.

Phenology: Unknown.

Distribution range: North Africa and Southwest Europe (southern Iberian and Apennine Peninsulas). Not found in the Levant.

15. *Zuphium fuscum* Gory, 1931

Dispersal power: Macropterous and flight active (numerous individuals at light).

Habitat selection: Unknown.

Phenology: Unknown.

Distribution range: Tropical Africa. Morocco (Machard 1997). Yemen (first record from Yemen: Al Kowd, Al Kadan, CFE).

Distribution in the Levant: Listed for Egypt (Baehr 2003). Alfieri (1976) negates the occurrence in Egypt. However, the species is known from the Palaearctic realm (see above) and an occurrence in oases of the southern Levant cannot be excluded.

Taxonomic notes: We studied the holotype and two syntypes in NHMP. The median lobe of the aedeagus (Fig. 9f) was extracted from a beetle caught in tropical Africa (CAB).

16. *Parazuphium damascenum* (Fairmaire, 1897)

Dispersal power: Macropterous and flight active (Orbach pers. comm., own observations).

Habitat selection: Especially in wetlands, mostly under stones. The species probably inhabits burrows of other soil organisms and cavities, e. g. crevices in rocks and gaps between stones.

Phenology: Unknown. Records from spring to summer (mainly at light).

Distribution range: From the Iberian Peninsula (Lencina & Serrano 1991) to Central Asia, Arabian Peninsula, and Iran (Felix 2009); from North Africa (Morocco to Egypt) in the south to Croatia in the north (Baehr 2003b). Also in Greece (first record: Peloponnese, Leimonas, CAB). Cyprus: The *Parazuphium* records listed by Austin et al. (2008, 2011) refer to this species (first records for Cyprus; see also *P. chevrolatii*).

Distribution in the Levant: Egypt (Alfieri 1976). Israel: Widely distributed, especially in the Coastal Plain and in the Jordan Valley from the Sea of Gallilee to the Dead Sea. Jordan: No record. Syria (first record): Deir-ez-Zor (leg. Mühle (?), CSS).

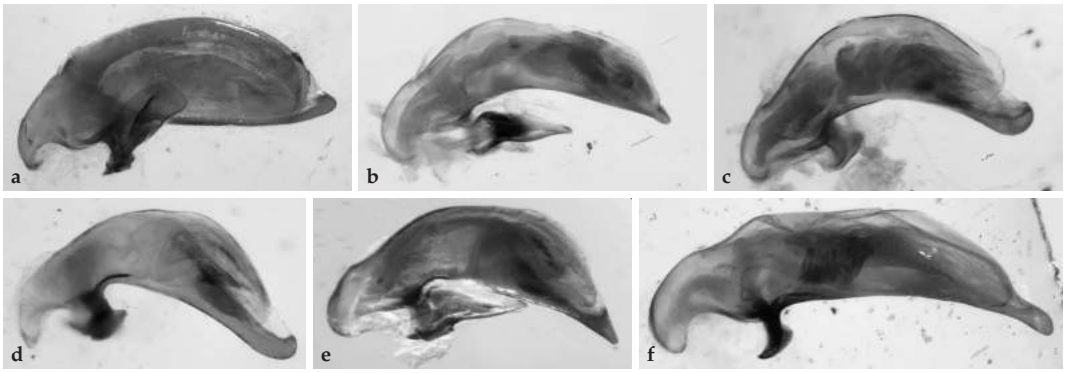

Fig. 8. Aedeagus of *Zuphium* species, left side: **a.** *Z. olens*, **b.** *Z. testaceum*, **c.** *Z. cilicium*, **d.** *Z. orbachi* spec. nov., **e.** *Z. numidicum*, **f.** *Z. fuscum*.

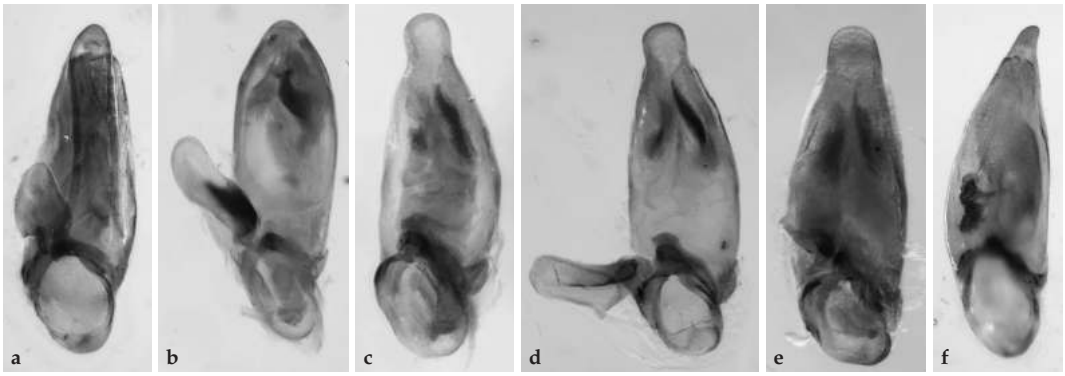

Fig. 9. Aedeagus of *Zuphium* species, ventral side: **a.** *Z. olens*, **b.** *Z. testaceum*, **c.** *Z. cilicium*, **d.** *Z. orbachi* spec. nov., **e.** *Z. numidicum*, **f.** *Z. fuscum*.

Taxonomic notes: Junior synonyms are listed by Mateu (1988). The subgenus *Neozuphium* Hůrka, 1982 established for *P. damascenum* was synonymized by Andujar et al. (2011).

17. *Parazuphium salmoni* spec. nov.

Dispersal power: Brachypterous.

Habitat selection: See description.

Phenology: Unknown.

Distribution range: See description.

18. *Parazuphium chevrolatii* (Castelnau de Laporte, 1833)

Dispersal power: Dimorphic (Allemand 1992, Fabbri & Degiovanni 2002), macropterous individuals also flight-active (Orbach pers. comm.).

Habitat selection: Different types of habitat: Dry grasslands, pastures etc. (we found the dark coloured individuals in Andalusia in such a habitat). Wetlands, reed beds, floodplains, etc., also found in shaded habitats (the yellow coloured individuals in the Middle East). These specimens seem to inhabit crevices, burrows of larger soil organisms, and many beetles are found under stones which cover these cavities. Also found deep in caves (Nitzu & Decu 1998).

Phenology: Unknown.

Distribution range: From the Iberian Peninsula to Turkmenistan and from North Africa to southern Central Europe. Also known from Lesbos (first record for Greece: Petra, NHMPr, Fig. 10c). Cyprus (only one record known: Paphos, Kidasi, CAB; Fig. 10d).

Distribution in the Levant: Israel: Several published records (e. g. Bodenheimer 1932 and 1937, Chikatunov et al. 2006), but all without verifiable specimens (also not in TAU); verified records are from Nahal Kziv (COQ) and Breichat Ya'ar close

Fig. 10. Habitus of *Parazuphium* species: **a.** *P. damascenum*, male, **b.** *P. damascenum*, female, **c–d.** *P. chevrolatii*.

to Hadera (CAB, Fig. 11a,b). Due to its flight activity, a wider distribution range in the Levant can be assumed.

Taxonomic remarks: *Parazuphium chevrolatii* is an extraordinarily variable species. Eye size can differ remarkably, even within one population (e. g. Breichat Ya'ar). This variability has already been described and illustrated by Müller (1934) for populations from the Adriatic region. Eye size dimorphism is known from the ground beetle *Melaenus elegans* Dejean, 1831 (Ball & Shpeley 2005). However, we do not have enough material to decide if a similar dimorphism also occurs in *Parazuphium chevrolatii*. In

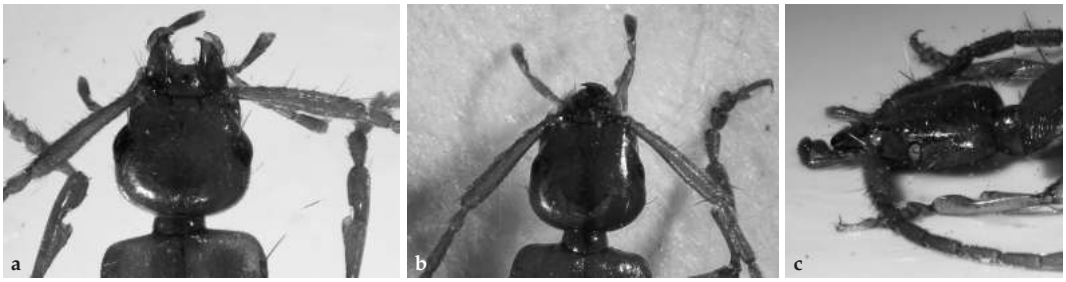

Fig. 11. Head of *Parazuphium* species: **a.** *P. chevrolatii* with large eyes, **b.** with small eyes, **c.** *P. salmoni* spec. nov.

some Zuphiini species the eye size differs greatly, e. g. in the troglobitic *Coarazuphium caatinga* Pellegrini & Ferreira, 2014, but does not show dimorphism (Pellegrini & Ferreira 2014). The hindwing development also differs greatly from fully-winged, flight-active individuals to flightless ones. Moreover, the general habitus of beetles with a dark head (Fig. 10c; and sometimes with dark elytra) differs from unicolorous yellow ones. This variability, which can also be found in other Zuphiini species (cf. Pellegrini & Ferreira 2014), is not covered by many identification keys (e. g. Andújar et al. 2011, Arndt et al. 2011) and can cause misidentifications. Due to this general morphological variability, it is questionable if all described subspecies, especially those based on a single or on very few type specimens, actually reflect differences between populations (cf. Hůrka & Pulpán 1981). Despite the exoskeletal variability the aedeagus shows some characters which seem to be consistent and enables reliable identification.

Descriptions of the new species

Zuphium orbachi Assmann, Renan, Friedman & Wrase, spec. nov.

Figs 7, 8d, 9d

Types. Holotype, male (TAU), and 5 paratypes (3♂♂, 2♀♀): ISRAEL: Har Meron Reserve, Peqi'in, 900 m, 32°59'N 35°20'E, 25.iv.2002, L. FRIEDMAN, 115473 (holotype). ISRAEL: / Dalton. Basalt / 11.III.1998 / T. PAVLIČEK, 115472 (1♀; TAU). N-Israel, Upper Galilee, Ziv'on near Meron, (150), N33°01' E035°25', ~700 m, 28./29.IV.2006, semi-open pasture, leg. Th. Assmann (2♂♂ in CAB). ISRAEL (North distr.), Upper Galilee, Meron Mts, Har Meron, Kamin Rom 1100 m, 32°59.447'N/035°24.669'E (open stony grazing land, limestone), 28.IV.2006 D.W. Wrase [15] (1♂, 1♀ in CWB).

Diagnosis. A slender, depigmented species of the *Zuphium numidicum* group with long first antennomere and sinuose lower side of the median lobe of aedeagus. Habitus, see Figure 7.

Description

BL 4.9–5.5 mm; EW 1.7–1.9 mm. Yellow to light brownish, the head sometimes darker, irregular brownish-reddish to light brownish.

Head large, somewhat triangular, temples prominent, slightly rounded. Eyes small, hardly protruding laterally, about half (or less) as long as tempora (Fig. 7). Antennae long, scapus (antennomere I) shorter than the head is wide (HW/A1L 1.09–1.16) and about 7 times longer than antennomere II, antennomere III one slightly longer than antennomere IV.

Fig. 12. Habitus of *Parazuphium salmoni* spec. nov.

Neck wider than one-third of head width. Surface shiny, with a weak microsculpture of isodiametric meshes, strongly punctated and haired.

Pronotum elongate, wider than head (HW/PW 0.83–0.9), longer than wide (PW/PL 0.84–0.9). Anterior angles strongly rounded, lateral border in the apical two-third slightly convexly rounded, strongly concavely curved at the prebasal excision and posterior angles acute and prominent (PBaW/PEW 1.05–1.2), excision of apical margin behind posterior angles deep. Median sulcus clearly developed, on the disc slightly impressed, strongly impressed at the anterior border and prominent at the prebasal excision, not reaching the basal margin. Strongly and regularly punctated and haired, microsculpture with isodiametric meshes stronger than those on the head.

Elytra subparallel, widened to the apex, elongate (more than one third longer than wide, EL/EW 1.37–1.44), much wider than pronotum (EW/PW 1.4–1.5). Apical margin evenly rounded. Inner striae more pronounced, alternative intervals sometimes more prominent. Series umbilicata consists of 7–9 humeral and 5-6 apical setae. Surface shiny with weak microsculpture (similar to pronotum), strong punctation with short and recumbent hairs. Brachypterous.

Legs of normal size, tibiae straight, only mesotibia on the inner side curved. Male protarsomeres I to IV enlarged and with adhesive setae on lower side.

Median lobe of aedeagus about 1 mm, the upper side strongly bent, the lower side sinuose; the apical part in lateral view rounded and bent upwards with pointed tip (Fig. 8d), in ventral view slightly truncate (Fig. 9d). Left paramere developed, right one strongly reduced. Preputial field (orificium) with two strongly sclerotized claps. Preputial or inner sac with numerous spines arranged in two groups, the right group more strongly developed than the left one (Fig. 9d).

Comparisons. The lack of additional setae on the first antennomere, chaetotaxy of the head, and the form of the median lobe of the aedeagus characterize the new species as a member of the genus *Zuphium*. The apical elytral margin which converges towards the suture, the eye size, and the fine pilosity are characters of a species group which comprises *Z. numidicum* Lucas, 1846 and two species which have been described from southeastern Europe and Asia Minor (*Z. hungaricum* J. Frivaldszky, 1877 and *Z. ponticum* K. & J. Daniel, 1898; the taxa *Z. bocagei* Paulino de Oliviera, 1876 and *Z. faillai* Reitter, 1887 are ranked as younger synonyms of *Z. numidicum*; Daniel & Daniel 1898, Baehr 2003b). Numerous characters in common are also the reason why some of us previously listed a part of the typical series of *Z. orbachi* spec. nov. under the name of *Z. numidicum* (Timm et al. 2008). Upon the finding and the study of the holotype of *Z. numidicum* (preserved in NHMP), the specific distinctness became obvious.

We were able to compare the Israeli specimens with the types of all three valid species of the above-mentioned group, with further material of *Z. numidicum* and all other *Zuphium* species with converging apical border of elytra (*Z. ciliatum* Vauloger de Beaupré, 1898, *Z. bedeli* Vauloger de Beaupré, 1897, *Z. cilicium* Peyron, 1858, *Z. orszuliki* Hůrka, 2001).

The new species can be differentiated from *Z. numidicum* by its larger body size, smaller head, larger eyes, brachyptery and especially by the form of the median lobe of aedeagus (Figs 6f, 8e, 9e). *Zuphium ponticum* and *Z. hungaricum* are similar to *Z. orbachi* spec. nov., but they are longer, their pronota are larger. *Z. ponticum* additionally differs from *Z. orbachi* spec. nov. in that the antennomere I is even longer and in that the median lobe of the aedeagi differs in the form of the lower side (cf. figures in Hůrka 2001). Only the holotype of *Z. hungaricum* is apparently preserved, the other specimen mentioned by Daniel & Daniel (1898) cannot be found in NHMB. As the studied holotype is a female, we cannot compare the male genitalia of the species, however the eye size and head shape of *Z. hungaricum* differ clearly from those of the new species (cf. fig. 2 in Hůrka 2001).

The median lobe of *Z. orbachi* spec. nov. is similar to that of *Z. cilicium* (cf. Figs 8c, 9c). However, the exoskeleta are clearly differently coloured, and the shape of the heads (especially eye sizes) and pronota differ between the two species (cf. Fig. 6e). The extraordinary ciliation of *Z. ciliatum* and the extremely reduced eyes in *Z. bedeli*, as well as characters of the male genitalia, clearly support the specific distinctness from *Z. orbachi* spec. nov. Finally, the last species described from this group, *Z. orszuliki*, can easily be distinguished by coloration, eye size, pronotum shape, and the form of the median lobe of aedeagus without sclerotized claps on the preputial field (see figs 1 and 4 in Hůrka 2001).

Etymology. It gives us great pleasure to dedicate the new species to our friend Eylon Orbach, the brentid and cerambycid specialist and enthusiastic entomologist, who has rich field experience in Israel and has explored the beetle fauna in several tropical African countries.

Distribution. Only known from Mount Meron and its foothills in the Upper Galilee. The species is flightless. Therefore, we assume that the species does not have a large distribution range.

Habitat. The beetles were found in batha habitats, mainly under deeply embedded stones (Fig. 17a; fig. 16 in Assmann et al. 2008a). Most specimens are from limestone habitats, but one paratype was found on basaltic rock. In one of the four paratype

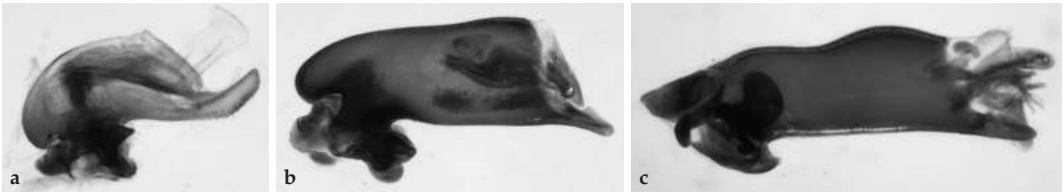

Fig. 13. Aedeagus of *Parazuphium* species, left side: **a.** *P. damascenum*, **b.** *P. chevrolatii*, **c.** *P. salmoni* spec. nov.

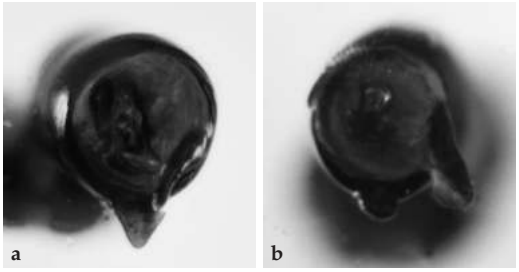

Fig. 14. Aedeagus of *Parazuphium* species, apex, view on preputial field: **a.** *P. chevrolatii*, **b.** *P. salmoni* spec. nov.

localities we also found the microphthalmic zuphiine species *Parazuphium salmoni* spec. nov. and the troglomorphic sphodrine species *Laemostenus antonrichteri* Casale, 1988. The two latter taxa seem to prefer deeper soil horizons or even the superficial underground compartment.

Parazuphium salmoni Assmann, Renan & Wrase, spec. nov.

Figs 11c, 12, 13c, 14b, 15b

Types. Holotype ♂ (TAU), and 2 paratypes (1♂, 1♀, CAB, CWB): N-Israel, Upper Galilee, Ziv'on near Meron, (150), N33°01' E035°25', ~700 m, 28./29.IV.2006, semi-open pasture, leg. Th. Assmann.

Diagnosis. A microphthalmic, depigmented, relatively small *Parazuphium* species with short and robust legs and antennae. Median lobe of aedeagus similar to that of *Parazuphium chevrolatii*. Habitus see Figure 12.

Description

BL 3.7–3.9 mm; EW 1.3–1.4 mm. Yellow to light brownish.

Head large, slightly triangular, with rounded temples. Eyes small, about one fourth as long as tempora (dorsal view) (Fig. 12, see also Fig. 11c). Antennae moderately long, scapus (antennomere I) shorter than width of the head (A1L/HW 0.8–0.9), about 6 times as long as antennomere II which

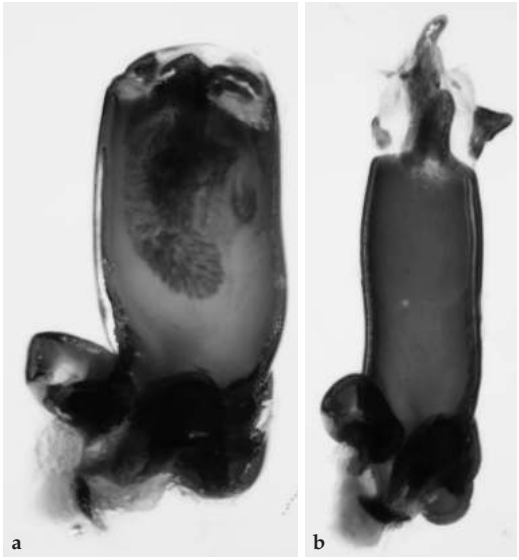

Fig. 15. Aedeagus of *Parazuphium* species, ventral view: **a.** *P. chevrolatii*, **b.** *P. salmoni* spec. nov.

is about 1.5 times longer than wide, antennomere III as long as antennomere IV (A3L/A4L 0.92-1). Neck wider than one-third of head width. Surface moderately shiny, with a microsculpture of isodiametric meshes.

Pronotum wider than head (HW/PW 0.83–0.85), slightly longer than wide (PW/PL 0.95–0.96). Anterior angles rounded, but prominent, lateral margin in apical two-third continuously rounded, concavely curved at the prebasal excision and posterior angles acute and prominent (PBaW/PEW 1.04–1.09), excision of apical margin behind posterior angles strong. Median sulcus fine, impressed to the posterior border, not reaching the basal margin. Regularly and more strongly punctated and haired than head, microsculpture with isodiametric meshes.

Elytra short (EL/EW 1.28–1.31), clearly widened to the apex. Apical margin sinuose. Inner striae more prominent. Series umbilicata consists of 8 (5 long and 3 short) humeral and 5 (3 long and 2 short) apical setae. Surface shiny, microsculpture with irregular

Fig. 16. Habitats of **a.** *Anthia duodecimguttata*, Wadi Rum, **b.** *Parazuphium damascenum* and *Drypta distincta*, Kfar Nachum (= Capernaum), Sea of Galilee.

Fig. 17. Habitats of **a.** *Parazuphium salmoni* spec. nov., *Zuphium orbachi* spec. nov., Ziv'on, the Upper Galilee, **b.** *Parazuphium chevrolatii*, *Zuphium olens*, *Drypta dentata*, Breichat Ya'ar, south of Hadera.

mesh form, less dense, regularly and more weakly punctated than pronotum. Brachypterous.

Legs robust and short, metatibia straight, mesotibia bent slightly outwards. Male protarsomeres I to IV enlarged and with adhesive setae on lower side.

Median lobe of aedeagus about 0.7 mm, strongly sclerotized, dorsal side sinuose, apex pointed (Fig. 13c). Preputial field with three sclerites, the central one large and prolonged, the left one rudimentary and the right one slightly triangular (Figs 14b, 15b). Left paramere rounded, larger than the strongly reduced right one.

Comparisons. The new species shows the characters of the genus *Parazuphium*: numerous erected small setae on the scapus, chaetotaxy of the head (one pair of supraorbital setae), sinuose apical margin of the elytra, and form of the median lobe of aedeagus. Within this genus, the species is characterized by a unique combination of small eyes, strong and relatively short appendices (especially legs and antennae), and the form of the median lobe of aedeagus. It can be distinguished from *P. chevrolatii*, which also occurs in the southern Levant, by its smaller eyes, shorter scapus (in *P. chevrolatii* as long as or even longer than head width), short antennomere II, very similar length of antennomeres III and IV, and by its stouter habitus. Both the general shape of the aedeagus and the sclerites of the preputial field (= orificium) are similar, but the median lobe is more elongate and the central element of the sclerites is slightly deviating, more pointed at the tip (Figs 13b,c, 14, 15), in *P. salmoni* spec. nov. *P. salmoni* spec. nov shares with *P. damascenum* the robust legs and the proportions of the antennomeres (especially the short antennomere II and the similar size of antennomeres III and IV), but it differs strongly in the shape of the median lobe of the aedeagus and in the eye size (Fig. 13a). The other microphthalmic species of the genus differ in slender legs, lengths and proportions of antennomeres, and form of the median lobe of aedeagus (*P. angustioculum* Hůrka, 1982, *P. baeticum* (K. & J. Daniel, 1898), *P. punicum* (K. & J. Daniel, 1898) and *P. ramirezi* J. & E. Vives, 1976).

A microphthalmic *Parazuphium* species was recently found in northern Jordan. The single female specimen is similar to *Parazuphium salmoni* spec. nov., but differs slightly in head form and eye size. Without the study of the median lobe of the aedeagus, it is not possible to decide if the population from northern Jordan belongs to the same or to another (still undescribed) one.

Etymology. It gives us great pleasure to dedicate this new species to our friend Oded Salmon, Harashim. We would like to thank him for his valuable information about soils, habitats and species in the Middle East. Moreover, he was the one who suggested we should study the type locality of the new species.

Distribution. Currently known only from the type locality. Due to the reduced eyes and the postulated small power of dispersal as the species is flightless (cf. Holdhaus 1954, Drees et al. 2010, Schuldt & Assmann, 2011), the distribution range is perhaps restricted to the karst massif of Mount Meron.

Habitat. All beetles were found in a pasture (Fig. 17a), on the lower sides of large embedded stones which were in contact with numerous crevices and cavities which seem to be part of the superficial underground compartment or of the superficial subterranean habitat (in the sense of Juberthie et al. 1980 and Giachino & Vailati 2010). The robust legs and the relatively short antennae may indicate that the species is endogeic. At the locus typicus we also recorded the subterranean, microphthalmic sphodrine species *Laemostenus antonrichteri* Casale, 1988.

Systematic-faunistic knowledge of the Zuphiinae in our study region

Two of the 18 species dealt with in this study are new to science, one species is recorded for the first time from the southern Levant, and four species are recorded (or listed) from surrounding countries but we do not know of any verifiable records from the southern Levant. We were able to successfully verify eight of the eleven species which have previously been published from the study region itself. Two species are without any verifiable records and were probably misidentified. One of the two new species was previously misidentified because it strongly resembles a species described more than one and a half centuries ago. A closer look at type material revealed its status of a new species. In summary, we changed the occurrence status of six species in the southern Levant (Table 1). But the overall number of Zuphiitae species from the Levant remains eleven.

Distribution of subterranean Zuphiini taxa worldwide

We found 24 listed subterranean species of the tribe Zuphiini (Table 2). Eight of these were recorded from the Americas (Mexico and Brazil) and ten from the Western Mediterranean region, with most of the species known from the Maghreb and the southern Iberian Peninsula. Western Australia harbours at least five species, only two of which have been described so far. We did not find any evidence for a known subterranean Zuphiini taxon from either Africa or from southeastern Asia (Fig. 18).

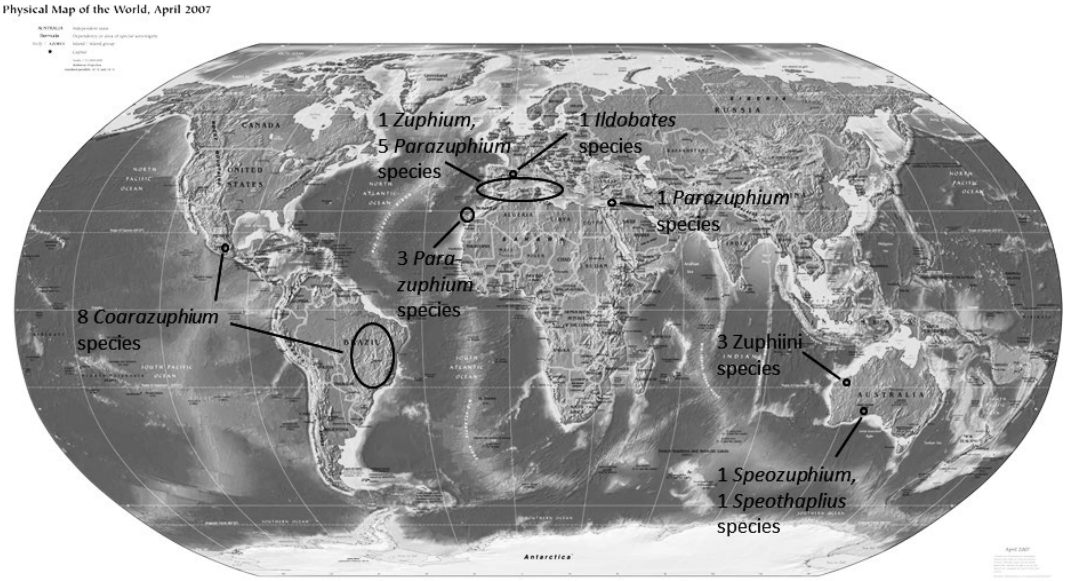

Fig. 18. Distribution of subterranean Zuphiini species.

Discussion

Although we did not change the overall number of eleven Zuphiitae species in the Levant, the six changes in occurrence status indicate a significant knowledge gap of these carabids in the study region. This concurs with the overall poor knowledge of the ground beetle fauna in the Middle East (Schuldt et al. 2009). We believe that further intensive field studies and thorough preparation with careful identifications of ground beetles are needed to improve the knowledge in these countries. In particular, additional methods to traditional pitfall trapping are needed to obtain a more complete understanding of the ground beetle fauna (e. g. for subterranean or plant-associated species; Cooter & Barkley 2006, Giachino & Vailati 2010). A combination of two methods (e. g. hand collection with turning stones and litter sifting) can find twice the number of species found by pitfall traps on a given site (Timm et al. 2008). As members of the genera *Drypta*, *Zuphium* and *Parazuphium* are excellent climbers, we believe that pitfall trapping alone will underestimate the number of species, especially from these tribes.

All known taxa of subterranean Zuphiini are restricted to tropical (*Coarazuphium*) and subtropical regions (Fig. 18), though the tribe also has some epigeic representatives in temperate regions. Despite incomplete recording, as many Zuphiini species, especially those from subterranean habitats, are not easy to discover, biogeographic patterns can nevertheless be discerned. The distribution patterns differ markedly from that of other subterranean ground beetle species and are – in comparison with them – restricted to subtropical and tropical regions: The large-scale distribution ranges of anophthalmic and microphthalmic Trechinae, Scaritinae and Harpalinae in the western Palaearctic realm are well known and culminate in the northern Mediterranean region (cf. Holdhaus 1954, Vigna-Taglianti 1982, Culver et al. 2006, Schuldt & Assmann 2011), from which no subterranean Zuphiini species are known. Although North Africa harbours some subterranean ground beetle species, their number seems to be low (at least in comparison to the North Mediterranean mountain chains, e. g. Antoine 1955–1962, Casale 1988 and 2011). But subterranean Zuphiini show a "diversity hotspot" in North Africa. The Balkan Peninsula and Asia Minor have a rich subterranean ground beetle fauna (Casale & Vigna-Taglianti 1999, Arndt et al. 2011) without any known subterranean Zuphiini species. The Middle East seems to be poor in endo- and hypogeic carabid species, except for the new subterranean *Parazuphium* species (only two additional subterranean species, Casale 1988, Bulirsch 1997; no subterranean trechine species known, Assmann et al. 2012). The distribution ranges of *Coarazuphium* in the Americas and the West Australian troglomorphic Zuphiini seem to have no overlap with anophthalmic or microphthalmic Trechinae which seem to occur in numerous species in temperate regions of these biogeographic realms (cf. Casale & Laneyrie 1982,

Table 1. Historical development of records of Zuphiitae in the southern Levant (Sinai, Israel, Jordan). Publications before 2000: Bodenheimer 1932, Schatzmayr 1936, Bodenheimer 1937, Alfieri 1976. Publications between 2000 and 2013: Baehr 2003a and 2003b, Bousquet 2003, Hůrka 2003, Chikatunov et al. 2006, Timm et al. 2008, Kleinfeld 2012; Häckel & Farkač 2013. X: record(s); –: no verifiable record(s).

Species	Publications before 2000	Publications between 2000 and 2013	This publication (only verifiable records)
1. *Macrocheilus saulcyi*	X	X	X
2. *Anthia sexmaculata*	X	X	X
3. *Anthia duodecimguttata*	–	X	X
4. *Anthia venator*	–	–	–
5. *Drypta dentata*	X	X	X
6. *Drypta distincta*	X	X	X
7. *Polistichus fasciolatus*	–	–	X
8. *Polistichus connexus*	–	–	–
9. *Zuphium olens*	X	X	X
10. *Zuphium syriacum*	–	X	–
11. *Zuphium testaceum*	–	–	–
12. *Zuphium cilicium*		X	–
13. *Zuphium orbachi* spec. nov.	–	–	X
14. *Zuphium numidicum*	–	X	–
15. *Zuphium fuscum*	–	–	–
16. *Parazuphium damascenum*	X	X	X
17. *Parazuphium salmoni* spec. nov.	–	–	X
18. *Parazuphium chevrolatii*	X	X	X

Table 2. Compilation of subterranean Zuphiini species.

Genus	Species	Country/region	Author(s)
Coarazuphium	*bezerra*	Brazil	Gnaspini et al. (1998)
Coarazuphium	*cessaima*	Brazil	Gnaspini et al. (1998)
Coarazuphium	*formoso*	Brazil	Pellegrini & Ferreira (2011b)
Coarazuphium	*pains*	Brazil	Álvares & Ferreira (2002)
Coarazuphium	*ricardoi*	Brazil	Bena & Vanin (2014)
Coarazuphium	*tapiaguassu*	Brazil	Pellegrini & Ferreira (2011a)
Coarazuphium	*tessai*	Brazil	Godoy & Vanin (1990), Gnaspini et al. (1998)
Coarazuphium	*whiteheadi*	Mexico	Ball & Shpeley (2013)
Ildobates	*neboti*	Spain: Castellón	Ortuño et al. (2004), Ribera et al. (2006)
Parazuphium	*feloi*	Canary Islands: La Palma	Machado (1998)
Parazuphium	*damascenum*	Canary Islands: Tenerife	Machado (1992)
Parazuphium	undescribed species	Canary Islands: Gran Canaria	Marcos Toribio: https://www.youtube.com/watch?v=I764XoFrKBI
Parazuphium	*baeticum*	Southern Iberian and Apennine Peninsulas, North Africa	Daniel & Daniel (1898), Hůrka (1982)
Parazuphium	*ramirezi*	South Spain	Vives & Vives (1976), Hůrka (1982)
Parazuphium	*punicum*	Morocco	Daniel & Daniel (1898), Hůrka (1982)
Parazuphium	*angustioculum*	Morocco	Hůrka (1982)
Parazuphium	*aguilerai*	Morocco	Andújar et al. (2011)
Parazuphium	*salmoni* spec. nov.	Israel	this publication
Parazuphium	*pilbarae*	Western Australia	Bennelongia (2013), Baehr (2014)
Speothalpius	*grayi*	Western Australia	Moore (1995)
Speozuphium	*poulteri*	Western Australia	Moore (1995)
Typhlozuphium	*humicolum*	Western Australia	Bennelongia (2013), Baehr (2014)
Typhlozuphium	*longipenne*	Western Australia	Bennelongia (2013), Baehr (2014)
Zuphium	*bedeli*	Algeria	Vauloger de Beaupré (1897)

Moore et al. 1987, Larochelle & Larivière 2001, Barr 2004, Townsend 2010, Bennelongia 2013, Baehr 2014).

Due to the numerous changes in systematics and faunistics we cannot exclude that further endo- and hypogeic species occur in the southern Levant. The record of a microphthalmic *Parazuphium* specimen from northern Jordan might be an indication of still undiscovered subterranean species. Ground beetle species with some morphological features which are typical for subterranean taxa (e. g. reduced eyes, depigmentation) have been recently found in the Middle East (e. g. *Porotachys ottomanus nitidiceps* and *Limnastis assmanni*, Coulon & Wrase 2009, Magrini & Wrase 2013). Despite their morphology and their occurrence in deep soil horizons or in caves, these species are not restricted to subterranean habitats as they are flight active and therefore are not subterranean species as per our definition. Their occurrence proves that subterranean habitats in the Levant harbour ground beetle species, not all of which are strictly restricted to this habitat. As the fauna of many of these habitats has apparently been overlooked in the past, we hope that the use of additional study techniques will increase our knowledge of the Middle Eastern ground beetle fauna.

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